Forest Pests and Climate Change

Bulletin Synopsis *August 2015*

Part 1: Overview of Climate-Pest Interactions

The most immediate and significant climate-related impacts on our forests will likely come in the form of insects and disease. Being ectothermic, insects are particularly sensitive to temperature – it directly influences their metabolic rate, consumption, development, and timing of life history stages – and forest pathogens are similarly sensitive to both temperature and moisture.

Characteristics that allow these organisms to rapidly respond to climate change, include: (1) physiological sensitivity to temperature, (2) high mobility, (3) short generation times, and (4) high reproductive potential.

Direct Climate Impacts – Higher overall temperatures (especially milder winters), longer and warmer growing seasons, changing snow pack, and climate variability will directly impact pest and pathogen population dynamics by (generally) increasing overwinter survival, enhancing infectiousness, increasing reproductive rates, and accelerating organism life cycles.

Indirect Climate Impacts – Pests will be affected indirectly via climate-related changes in host plants (distribution, nutritional quality, resistance, phenology, and rate of development), natural enemies, competitors, and mutualists. An increase in abiotic damage (from storms, drought, extreme heat, etc) will increase tree stress and make hosts more susceptible to attack.

Part 2: Summary of Anticipated Impacts

Asynchrony/Ecological Mismatches: Changes in seasonality may shift the timing of developmental stages, so pecies that have historically been tightly linked may no longer be in alignment. This could exacerbate or alleviate pest impacts, depending on the species involved.

Range Shifts/Redistribution: Hosts and pests may become misaligned geographically due to climatically-driven changes in species ranges. Generalist pest species will likely fare better and experience range expansion, while more specialized species will likely experience ranges shifts or contractions. This may be good or bad for forest ecosystems, depending on the species and region in question.

Changing Pest Populations & Outbreak Frequency: Some research suggests warming will lead primarily to pest distribution shifts (toward higher latitudes and altitudes), rather than an increase in outbreaks. However, climate change is also likely to amplify abiotic stressors, which creates conditions favorable for more frequent and intense outbreaks. In particular, it is likely that warmer temperatures will allow many herbivorous insect species to have additional generations per year, which will increase populations and the level of herbivory.

Increased Pathogen Infectiousness: Evidence suggests that increased humidity and temperature associated with climate change will increase pathogen infection rates. These organisms are generally able to evolve, adapt, and migrate more quickly than their hosts, so their role in forest disturbance regimes will probably increase.

Increased Vulnerability in Water-Stressed Regions: Significant pest-related impacts will occur in regions with more frequent or severe drought conditions. This is particularly true for insect groups and pathogens that typically affect water-stressed trees.

Note: See Part 3 of the full bulletin for descriptions of anticipated climate change impacts for a selection of example pests and pathogens from different regions.

Conclusion

Insects and disease have always been recognized as serious threats to forests and there are many information resources available, but things are changing rapidly and local knowledge is a critical piece of this evolving puzzle. **Stay connected** with state insect and disease departments, as well as arborist information sources. **Monitor** to detect early changes in pest behavior and abundance. **Stay alert to new information**, especially looking beyond your ownership for pests that have the potential to move into your region as a result of climatic shifts. **Spread your knowledge** to others.

Click on the sub-headings above to go directly to the corresponding section of the full bulletin, or read the full bulletin online:
http://climatesmartnetwork.org/2015/08/forest-pests-and-climate-change/